

WHAT IS CLAIMED IS:

1. A projection exposure apparatus comprising:
an illumination optical system for illuminating a
first object;

5 a projection optical system for projecting an
image of said first object illuminated by said
illumination optical system onto a second object under
a predetermined magnification; and

10 an optical means set between said first object and
said second object, having rotationally asymmetric
powers with respect to an optical axis of said
projection optical system, for correcting an optical
characteristic rotationally asymmetric with respect to
the optical axis of said projection optical system,
remaining in said projection optical system.

15 2. A projection exposure apparatus according to
Claim 1, wherein said optical means is arranged as
rotatable about the optical axis of said projection
optical system.

20 3. A projection exposure apparatus according to
Claim 1, wherein said optical means is arranged as
movable along the optical axis of said projection
optical system.

25 4. A projection exposure apparatus according to
Claim 1, wherein said optical means comprises a toric
optical member having different powers in orthogonal

directions.

5 5. A projection exposure apparatus according to
Claim 4, wherein said toric optical member comprises
first and second toric optical elements each having
different powers in orthogonal directions,

wherein said first and second toric optical
elements are arranged as relatively rotatable about the
optical axis of said projection optical system.

10 6. A projection exposure apparatus according to
Claim 4, wherein said toric optical member comprises
first and second toric optical elements each having
different powers in orthogonal directions,

15 wherein said first and second toric optical
elements are arranged as relatively movable along the
optical axis of said projection optical system.

20 7. A projection exposure apparatus according to
Claim 1, wherein said optical means is set either
between said first object and said projection optical
system, inside said projection optical system, or
between said projection optical system and said second
object.

25 8. A projection exposure apparatus according to
Claim 1, wherein said optical means is set at or near
the pupil plane of said projection optical system.

9. A projection exposure apparatus according to
Claim 1, wherein said first object is a reticle a

pattern to be projected is formed thereon.

10. A projection exposure apparatus according to Claim 1, wherein said second object is a semiconductor wafer.

5 11. A projection exposure apparatus comprising:
an illumination optical system for illuminating a first object; and

10 a projection optical system for projecting an image of said first object illuminated by said illumination optical system onto a second object under a predetermined magnification;

15 wherein said projection optical system comprises a lens, the surface thereof contributes to imaging performance of said projection optical system and has a rotationally asymmetric region having rotationally asymmetric powers with respect to the optical axis of said projection optical system, in order to correct an optical characteristic rotationally asymmetric with respect to the optical axis of said projection optical system.

20 25 12. A projection exposure apparatus according to Claim 11, wherein said lens is arranged as rotatable about the optical axis of said projection optical system.

13. A projection exposure apparatus according to Claim 11, wherein said lens is arranged as movable

along the optical axis of said projection optical system.

5 14. A projection exposure apparatus according to Claim 11, wherein said lens comprises first and second lens elements each having different powers in orthogonal directions.

10 15. A projection exposure apparatus according to Claim 11, wherein said first object is a reticle a pattern to be projected is formed thereon.

16. A projection exposure apparatus according to Claim 11, wherein said second object is a semiconductor wafer.